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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/659,484	09/11/2000	Takeshi Takagi	0819-374	9022

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EXAMINER

LOUIE, WAI SING

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 10/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/659,484

Applicant(s)

TAKAGI ET AL.

Examiner

Wai-Sing Louie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,5,6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 6 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- In claim 6, it is unclear what is meant by “concentration of carrier”. For the purpose of examination, “doping concentration” is assumed.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C.

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122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1 and 5-7 are rejected under 35 U.S.C. 102(e) as being anticipated by Yagura et al. (US 5,719,415).

With regard to claim 1, Yagura et al. disclose a hetero-junction bipolar transistor (col. 4, line 29 to col. 9, line 40 and fig. 1) having:

- A high-concentration doped layer 7 being provided in the emitter layer 8 and doped with the impurity of the first conductivity type at a higher concentration than the emitter layer 8 (col. 4, lines 43-45).

With regard to claim 5, Yagura et al. disclose the high-concentration doped layer 7 is adjacent to an emitter/base junction, which forms a depletion region (fig. 1).

With regard to claim 6, Yagura et al. disclose the doping concentration of the second conductivity type in the base layer is higher than the doping concentration of the first conductivity type in the emitter layer (Table 1).

With regard to claim 7, Yagura et al. disclose the emitter layer and the base layer are composed of two types of semiconductor material (Table 1) having different band gaps, where the bandgap of the emitter layer is wider than the bandgap of the base layer (col. 2, lines 38-39), the bipolar transistor having a heterojunction portion between the emitter and the base layer (col. 2, lines 34-55 and fig. 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yagura et al. (US 5,719,415) in view of Jorke (US 5,798,539).

With regard to claims 2-4, Yagura et al. do not disclose the high-concentration doped layer 7 is Δ -doped. However, Jorke discloses both base and emitter layers are Δ -doped (Jorke col. 3, line 67) and the other layers in the bipolar transistor structure can be Δ -doped (Jorke col. 4, lines 7-21). Jorke teaches the Δ -doping could reduce the storage times for minority carriers (Jorke col. 4, lines 1-2). Hence, it would have been obvious to one with ordinary skill in the art to Δ -dope layer 7 in Yagura to improve the mobility of the minority carriers.

Yagura et al. disclose the thickness of the high-concentration doped layer 7 is 5 nm and the concentration of doping of layer 7 is $5 \times 10^{18} \text{ cm}^{-3}$, but is lower than the 1×10^{19} listed in the claim. However, in the case where the claimed ranges "overlap or lie inside the ranges disclosed by the prior art" a prima facie case of obviousness exists (In re Wetheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990)). Similarly, a prima facie case of obviousness exists where the claimed ranges and the prior art ranges do not overlap but are close enough that one skill in the art would have expected them to have the same properties (Titanium Metals Corporation of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985); See MPEP 2144.05).

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The doping concentration of layer 7 is ten times higher than the concentration of the emitter layer 6 (col. 3, lines 40-42 and Table 1).

Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yagura et al. (US 5,719,415).

With regard to claims 8-10, Yagura et al. do not disclose the base layer is strained. However, the base layer is GaAs and the emitter layer is InGaP. Therefore, the strain exists when an InGaP layer is formed on top of GaAs base layer.

Yagura et al. solve the strained layer problem by inserting a plurality of graded layers in between the base, etch stop, emitter, and cap layers (fig. 1). Yagura et al. disclose, in claim 7 above, the bandgap of the emitter layer is wider than the bandgap of the base layer (col. 2, lines 38-39). The graded layers provide lattice matching between layers (col. 2, lines 27-30). At the same time, the graded layer is also gradually decreasing the bandgap energy from the emitter layer to the base layer (col. 1, lines 64-67 and col. 4, lines 46-50).

Yagura et al. do not disclose the base layer is SiGe, but Yagura et al. disclose the doped SiGe can be used as a base layer (col. 8, lines 44-45). Therefore, it would have been obvious to have a SiGe base layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsl

October 1, 2002


Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800